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A bottom trawl survey on the west side of Kodiak Island: Viekoda Bay, Spiridon Bay, and Kupreanof Strait (November 1987)

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ABSTRACT

A hard-on-bottom trawl survey was conducted to determine current bycatch rates of prohibited species (halibut and crab) in three areas on the west side of Kodiak Island that are closed to bottom trawl fishing. A total of 18 trawls using a Bering Sea Combination net was made in Viekoda Bay, Spiridon Bay, and Kupreanof Strait in November 1987. Largest catches of fish were made in Spiridon Bay (16,854 kg/hr) consisting mostly of yellowfin sole, starry flounder and flathead sole. Lesser catches were taken in Viekoda (6615 kg/hr) and Kupreanof Strait (5805 kg/hr). Bycatch rates of halibut were lowest in Spiridon Bay (4-6 kg/mt) compared to the other two areas (48-79 kg/mt). Tanner crab were more evenly distributed in the three study areas (6-16 kg/mt). Few king crab were found and only in Viekoda Bay (1 kg/mt). No soft shell crab were caught. Trawl-induced mortalities aboard ship were 12% for Tanner crab, 19% for red king crab, and 0% for Dungeness.

INTRODUCTION

The Alaska Board of Fisheries closed many Kodiak waters (0 to 3 miles) to bottom trawling because of concern for the potential bycatch of crab, halibut, and other species. In 1987 the Alaska Department of Fish and Game (ADF&G) and the Kodiak Groundfish Committee initiated a test fishery program to determine current bycatch rates in these waters. This report presents the results of the first survey conducted in November 1987. The three areas fished (Viekoda Bay, Spiridon Bay, and Kupreanof Strait) are located on the west side of Kodiak Island (Figure 1). The objective of the survey was to determine bycatch rates using a commercial bottom trawl commonly used in the Kodiak area to target flatfish and Pacific cod.

METHODS

The study area included two long and narrow bays and the channel between Kodiak and Afognak Islands (Figure 1). Typical water depths in the deepest portions of the three areas were 50-100 fm in Kupreanof Strait, 50-80 fm in Spiridon Bay, and 60-130 fm in Viekoda Bay. Each area was partitioned primarily by the grid pattern that ADF&G uses during its shrimp surveys. Figure 1 shows the locations of trawl samples. Temperature profiles were taken at several stations.

The survey vessel, a commercial trawler (F/V Hickory Wind), towed two different nets (both Bering Sea Combination nets) during the survey. The first net was used for all but the last two tows when it ripped badly. It had a 24 m (78 ft) headrope with 20 floats 30 cm (12 in) in diameter. The footrope was 33 m (103 ft) long with 23 cm (9 in) roller gear placed every 1.2 m (4 ft) separated by 10 cm (4 in) disks. The second net was larger. It had a 28 m (92 ft) headrope with the same number and size of floats. The footrope was 37 m (122 ft) long with the same roller gear as the first net. The body of both nets had 141 mm (5 1/2 in) mesh while the codend had 90 mm (4 in) mesh. The doors were

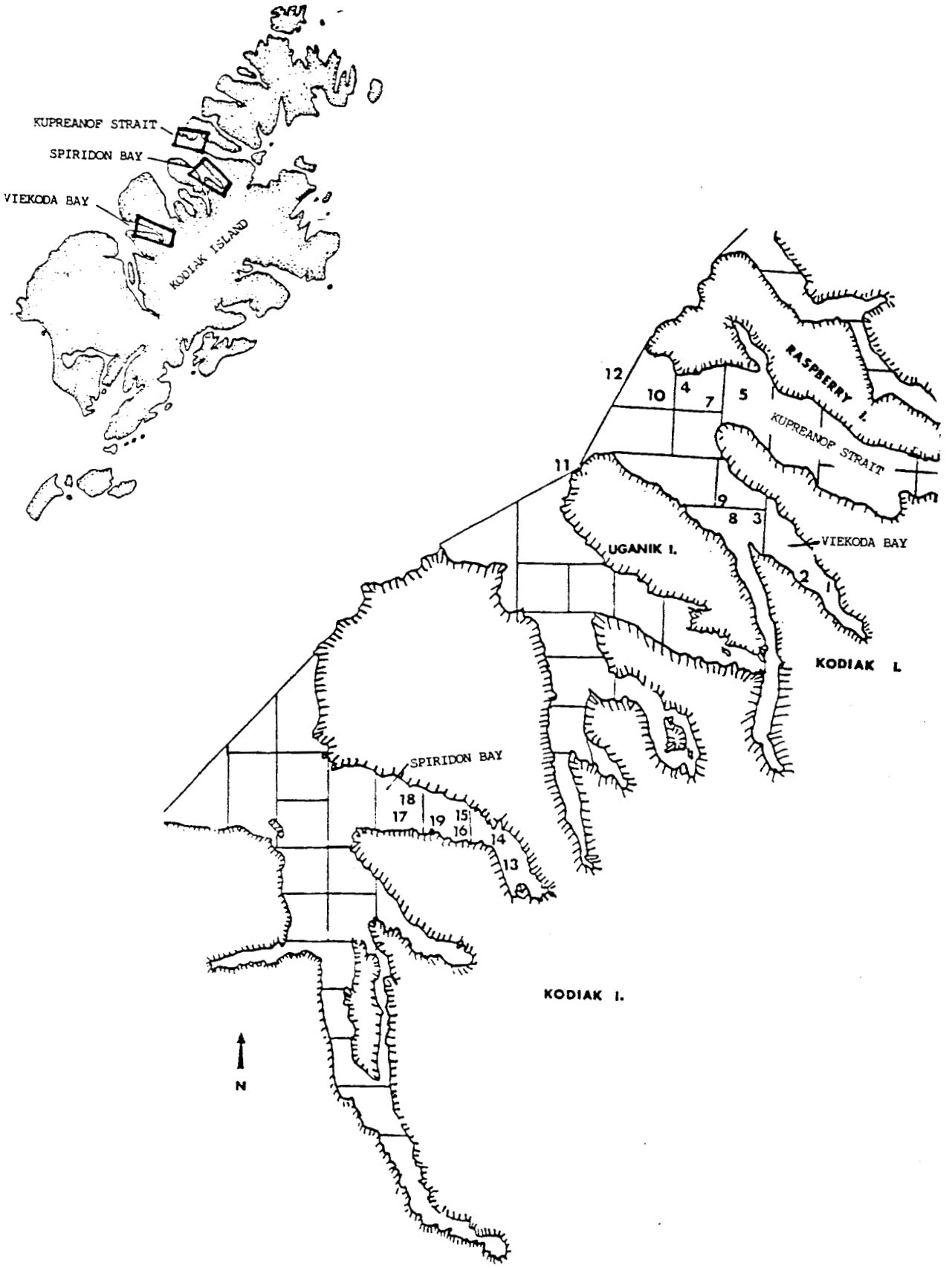

Figure 1. Study area and locations of individual bottom trawl sites, November 1987.

3.5 m "V" style doors weighing 1800 pounds. The sweeplines (0.75 in cable) for both nets were 82 m (270 ft) with 76 mm (3 in) rubber disks used as mud gear on 55 m (180 ft) cable lengths.

The total weight of organisms in each trawl haul (fish and invertebrates combined) was determined by weighing the codend before and after the catch was released on deck. A crane scale accurate to the nearest 4.5 kg (10 lb) was used for this purpose. All large fish and other fish of special interest were individually removed from the catch: halibut, king crab, Tanner crab, Dungeness crab, large skates and sablefish. Halibut and big skates were measured and returned to the sea; a length-weight relationship was used to estimate their weight. The remainder of the catch was subsampled by bushel baskets. A four-basket subsample was sorted to species and members of each species were counted and weighed. Carapace widths were measured on Tanner and Dungeness crab and carapace lengths were measured on king crab. Shell hardness was determined for each crab species by using the following criteria:

Shell Condition	Criteria
Soft shell	Newly molted crab that were obviously soft or with chela that were easily compressable between thumb and forefinger.
New shell	Newly molted crab with chela that were not compressable between thumb and forefinger. The dorsal side of the carapace is brownish-red and have whiteish ventral surfaces with relatively few scratches.
Old shell	Typically have a brownish carapace with yellowish ventral surfaces with dark stained scratches. Epifauna may be present.
Very old Shell	Carapace dark brown to blackish. Thoracic sternum and ventral side of legs with multiple scratches and abrasions. Underside of legs may be dark yellow-brown. Epifauna most always present.

Fork lengths were measured on several groundfish species

including halibut.

A Wilcoxon rank sum test was used to compare abundances of species above and below the 50 fm depth.

RESULTS AND DISCUSSION

Temperature profiles were taken during hauls 5, 8, and 12. The water column was well mixed with a uniform profile of 6.5 - 7.5^{0}C (43.7 - 45.5^{0}F).

Five hauls were taken in Viekoda, seven in Spiridon Bay and six were taken in Kupreanof Strait (Figure 1). Depths of the 18 trawls ranged from 14 to 82 fathoms. Details about individual tows and their catches are presented in Appendix 1.

Some methodological differences occurred among the 18 trawls completed. Hauls 1-17 were towed with a net with a 103' footrope while tows 18-19 were towed with a net with a 123' footrope (other net dimensions were similar for the two nets.) After the last two tows in Spiridon, the survey was stopped because the net appeared to be dragging into the sea bottom and was not fishing properly. For hauls 1, 2, and 4, it should be noted that one of the doors flipped at some point during the tow. Haul 6 was aborted.

Species Composition And Relative Abundance

The total catch rate for Spiridon (16,584 kg/hr) was over 2.5 times greater than that found in Viekoda Bay (6615 kg/hr) or Kupreanof Strait (5805 kg/hr) (Table 1). The main species accounting for these differences were flathead sole, starry flounder, and yellowfin sole. The main roundfish species was pollock with highest catches coming from Viekoda Bay (1837 kg/hr), then Spiridon Bay (990 kg/hr) and Kupreanof Strait (461 kg/hr). The haul by haul abundance for selected species are

Table 1. Total catch (kg/hr) by area caught during the ADF&G November trawl survey, Kodiak Island.

SPECIES (KG/HR)	VIEKODA n=5 tows	KUPREANOF n=6 tows	SPIRIDON n=7 tows
DUNGENESS CRAB (M)	1.8	0.8	4.9
DUNGENESS CRAB (F)	1.5	0.1	1.1
TOTAL DUNGENESS CRAB	3.3	0.9	6.0
RED KING CRAB (M)	2.7	0.0	0.0
RED KING CRAB (F)	0.6	0.0	0.0
TOTAL KING CRAB	3.4	0.0	0.0
TANNER CRAB (M)	19.1	6.2	21.2
TANNER CRAB (F)	9.3	3.3	17.9
TOTAL TANNER CRAB	28.4	9.5	39.1
TOTAL CRAB	35.0	10.4	45.1
OTHER INVERTEBRATES	110.2	109.9	243.9
ALASKA PLAICE	198.8	52.1	116.8
ARROWTOOTH FLOUNDER	488.4	2731.5	872.4
BUTTER SOLE	0.0	9.3	10.2
DOVER SOLE	88.5	242.2	109.9
ENGLISH SOLE	12.6	234.3	682.9
FLATHEAD SOLE	1945.0	694.0	3505.4
HALIBUT	286.1	139.0	61.5
REX SOLE	52.9	369.3	0.0
ROCK SOLE	98.4	129.5	55.6
STARRY FLOUNDER	407.4	0.0	3996.8
YELLOWFIN SOLE	744.1	159.3	5653.9
TOTAL FLATFISH	4322.7	4757.5	15065.4
DUSKY ROCKFISH	0.0	14.0	0.0
HERRING	0.0	0.0	9.6
PACIFIC COD	187.2	122.4	57.6
POLLOCK	1837.1	460.9	990.3
SABLEFISH	8.0	164.6	20.7
SCULPINS	102.9	142.3	99.9
OTHER ROUNDFISH	2.4	8.1	46.8
TOTAL ROUNDFISH	2137.6	912.3	1224.9
SKATES	10.0	12.0	274.2
GRAND TOTAL	6615	5805	16854

presented in Appendix 2.

Halibut And Crab Bycatch

Bycatch rates of halibut and crab caught during this survey (in both kg and number of fish caught) are expressed two ways: per hour of trawling (kg/hr, no/hr), and per metric ton of the landed weight of commercial species (kg/mt, no/mt). Landed weights were calculated for two categories of marketable groundfish - all pollock, sablefish, and Pacific cod plus (a) all flatfish over 10 inches excluding arrowtooth flounder (b) all flatfish over 12 inches excluding arrowtooth flounder.

A total of 276 halibut was caught, mostly in Viekoda Bay (67%) where over 107 (39%) were taken in a single tow (Haul 3). Catch rates of halibut (expressed either per hour of trawling or per metric ton of landed weight of commercial species) were highest in Viekoda Bay followed by Kupreanof Strait and notably lower in Spiridon Bay (Table 2).

The crab bycatch consisted of 349 crabs of which 87% were Tanner crab, 8% Dungeness crab, and 4% king crab. Highest numbers of Tanner crab and Dungeness were caught in Spiridon Bay, mainly from Hauls 18 and 19. Highest bycatch rates for Tanner and Dungeness crab differed between study areas depending on the units of measure used (Table 2). King crab were caught only in Viekoda Bay in hauls 2 and 3.

Crab Mortality

Trawl-induced mortality rates for crab brought aboard ship were calculated for each shell age category by combining all crab caught from all sample areas. No soft shell crab were observed. A total of 19% of the Tanner crab were dead with most mortalities (28%) occurring in crab categorized as new shell (Table 3). All the red king crab were new shell with a 19%

Table 2. Bycatch rates for halibut, red king crab, Tanner crab and Dungeness crab in study areas during the November 1987 ADF&G trawl survey, Kodiak Island. Bycatch estimates per metric ton of landed product were determined in two ways based on two standards of marketability for flatfish (i.e. all flatfish greater than 10 or 12 inches .. see footnote). Bycatch estimates per trawl hour were not similarly affected.

Prohibited Species	Bycatch Units	Viekoda Bay (n=5 tows) 10"	12"	Spiridon Bay (n=7 tows) 10"	12"	Kupreanof Strait (n=6 tows) 10"	12"
Halibut	no./hr	125	125	16	16	47	47
	no./mt*	22	28	1	1	17	23
	kg/hr	286	286	62	62	139	139
	kg/mt*	61	79	4	6	48	66
Tanner crab	no./hr	69	69	111	111	33	33
	no./mt*	12	16	8	9	12	17
	kg/hr	28	28	39	39	10	10
	kg/mt*	6	15	8	9	12	16
Red king crab	no./hr	11	11	0	0	0	0
	no./mt*	2	2	0	0	0	0
	kg/hr	3	3	0	0	0	0
	kg/mt*	1	1	0	0	0	0
Dungeness crab	no./hr	5	5	2	2	13	13
	no./mt*	1	1	1	1	1	1
	kg/hr	3	3	6	6	1	1
	kg/mt*	1	1	1	1	0.4	1

*mt = metric ton of landed weight of commercial species. Because samples were not actually "landed" at port for commercial sale, we estimated landed weight by summing weights of all pollock, Pacific cod, and sablefish caught, together with all flatfish (except arrowtooth flounder) that were larger 10 inches and then 12 inches.

Table 3. Shell condition and mortality of crab species caught during the November 1987 ADF&G trawl survey in Viekoda, Spiridon, and Kupreanof Strait, Kodiak Island.

Shell Condition	----Tanner Crab--- No.Crab Caught	Alive (%)	Dead (%)	-----King Crab---- No.Crab Caught	Alive (%)	Dead (%)	--Dungeness Crab-- No.Crab Caught	Alive (%)	Dead (%)
Soft Shell	0	0	0	0	0	0	0	0	0
New Shell	87	72	28	16	81	19	27	100	0
Old Shell	69	96	4	0	0	0	0	0	0
Very Old Shell	148	94	6	0	0	0	0	0	0
Totals	304	88	12	16	81	19	27	100	0

mortality rate. No Dungeness mortalities were observed.

Length Frequency

Size measurements of several flatfish species, pollock, sablefish, halibut, and crab species are listed by study area in Appendices 3-6. For the bycatch species, 25% Dungeness crab, 7% halibut, 7% Tanner crab, and no king crab were of a commercially legal size.

Depth Distribution

Most species appeared to be distributed by depth (Table 4). Of those whose depth differences were statistically significant ($P < 0.05$), yellowfin sole, rock sole tended to be shallower than 50 fathoms while halibut and Dover sole tended to be deeper than 50 fathoms.

ACKNOWLEDGEMENTS

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Table 4. Depth distribution of selected species (kg/hr) caught during the ADF&G trawl survey in Viekoda Bay, Spiridon Bay, and Kupreanof, November 1987.

Depth (fm)	#Tows	Tanner Crab	King Crab	Dunge Crab	Hali-but	Rock Sole	Alaska Plaice	Fhead Sole	Yfin Sole	Starry Flound	Engl. Sole	Dover Sole	Pol-lock	Sable-fish	Pac. cod
10-19	2	0	0	1	16	64	0	393	18405	2563	0	0	672	0	0
30-39	2	1	0	2	34	386	419	339	1270	338	0	0	5	0	25
40-49	4	12	3	4	121	133	187	1430	829	5623	463	36	536	197	67
50-59	3	45	0	12	85	27	174	2631	295	374	377	115	169	60	108
60-69	2	70	0	2	97	14	0	1200	25	9	0	228	118	54	32
70-79	3	11	0	0	192	40	5	5898	219	194	1089	546	2768	32	456
80-89	2	58	3	1	535	0	0	1627	8	0	0	41	3169	1	0
(fm)					Mean abundance (kg/hr) above and below 50 fm										
<50	8	6	1	3	73	379	198	898	533	354	231	18	437	90	32
>50	10	42	1	4	209	23	54	3124	161	17	44	252	1538	39	176
P		.161			.028	.019	.133	.116	.027	.082	.466	.004			

Appendix 1. Haul data from the November 1987 ADF&G trawl survey, Kodiak Island.
Gear performance codes: 1)successful trawl 2) door flipped
Net type codes: 1)103′ footrope. 2)123′ footrope (See methods).

HAUL NUMBER	1	2	3	4	5	7
BAY OR STATION	VIEKODA	VIEKODA	VIEKODA	KUPREANOF	KUPREANOF	KUPREANOF
STATION NUMBER	KUM-A	KUM-B	KUL-B	KUF-A	KUE-A	KUF-B
MONTH/DAY/YEAR	11/12/87	11/12/87	11/12/87	11/13/87	11/13/87	11/13/87
LATITUDE START	57 51	57 52	57 55	58 01	58 01	57 59
LONGITUDE START	153 08	153 10	153 18	153 20	153 13	153 14
DEPTH (FATHOMS)	35	40	80	45	33	70
DURATION (MINUTES)	15	15	28	15	15	10
DISTANCE TOWED (KM)	1.39	1.39	2.59	1.39	1.39	0.93
GEAR PERFORMANCE	2	2	1	2	1	1
NET TYPE	1	1	1	1	1	1
TOTAL CATCH (KG)	1260	1233	1977	1070	421	684
TOTAL CATCH (KG/HR)	5040	4932	4236	4280	1684	4104
TOTAL CATCH (KG/M^2)	0.07	0.07	0.06	0.06	0.02	0.05
			SPECIES (KG/HR)			
DUNGENESS CRAB (M)	2.0	6.8	0.0	4.8	0.0	0.0
DUNGENESS CRAB (F)	2.0	4.4	1.1	0.8	0.0	0.0
TOTAL DUNGENESS CRAB	4.0	11.2	1.1	5.6	0.0	0.0
RED KING CRAB (M)	0.0	10.8	2.8	0.0	0.0	0.0
RED KING CRAB (F)	0.0	0.4	2.8	0.0	0.0	0.0
TOTAL KING CRAB	0.0	11.2	5.6	0.0	0.0	0.0
TANNER CRAB (M)	1.6	1.6	27.2	25.2	0.0	0.6
TANNER CRAB (F)	0.4	5.6	24.2	14.4	0.0	0.0
TOTAL TANNER CRAB	2.0	7.2	51.4	39.6	0.0	0.6
TOTAL CRAB	6.0	29.6	58.1	45.2	0.0	0.6
OTHER INVERTEBRATES	311.8	128.9	55.3	248.8	162.6	182.2
ALASKA PLAICE	795.4	181.3	0.0	269.3	43.1	0.0
ARROWTOOTH FLOUNDER	95.4	330.4	390.1	584.0	38.9	1643.1
BUTTER SOLE	0.0	0.0	0.0	0.0	55.6	0.0
DOVER SOLE	0.0	0.0	33.2	0.0	0.0	507.9
ENGLISH SOLE	0.0	0.0	0.0	444.5	0.0	23.9
FLATHEAD SOLE	503.7	1192.6	1023.6	1327.1	175.1	304.7
HALIBUT	16.4	15.2	712.2	209.2	51.2	222.0
REX SOLE	0.0	0.0	0.0	42.2	1.4	349.5
ROCK SOLE	151.1	278.0	0.0	71.4	619.9	6.0
STARRY FLOUNDER	676.1	1164.4	0.0	0.0	0.0	0.0
YELLOWFIN SOLE	2089.1	1587.5	16.6	389.4	450.3	35.8
TOTAL FLATFISH	4327.3	4749.4	2175.6	3337.1	1435.5	3092.9
DUSKY ROCKFISH	0.0	0.0	0.0	0.0	0.0	0.0
HERRING	0.0	0.0	0.0	0.0	0.0	0.0
PACIFIC COD	0.0	0.0	0.0	146.0	49.6	93.0
POLLOCK	0.0	16.1	1795.4	64.9	9.7	472.0
SABLEFISH	0.0	0.0	2.6	0.0	0.0	18.0
SCULPINS	387.1	4.0	99.6	434.8	19.5	173.3
OTHER ROUNDFISH	8.0	4.0	0.0	3.2	6.9	0.0
TOTAL ROUNDFISH	395.1	24.2	1897.6	648.9	85.7	756.3
SKATES	0.0	0.0	49.8	0.0	0.0	72.0

Appendix 1. (Continued).

HAUL NUMBER	8	9	10	11	12	13
BAY OR STATION	VIEKODA	VIEKODA	KUPREANOF	KUPREANOF	KUPREANOF	SPIRIDON
STATION NUMBER	KUL-A	KUK-B	KUG-B	282-B	254-	UYI-B
MONTH/DAY/YEAR	11/14/87	11/14/87	11/14/87	11/14/87	11/14/87	11/16/87
LATITUDE START	57 55	57 55	58 01	58 01	58 02	57 37
LONGITUDE START	153 15	153 18	153 25	153 28	153 30	153 38
DEPTH (FATHOMS)	72	82	50	47	60	15
DURATION (MINUTES)	15	16	15	15	15	15
DISTANCE TOWED (KM)	1.39	1.48	1.39	1.39	1.39	1.39
GEAR PERFORMANCE	1	1	1	1	1	1
NET TYPE	1	1	1	1	1	1
TOTAL CATCH (KG)	2698	2154	1424	2154	2608	5443
TOTAL CATCH (KG/HR)	10792	8078	5696	8616	10432	21772
TOTAL CATCH (KG/M^2)	0.14	0.11	0.08	0.12	0.14	0.29
			SPECIES (KG/HR)			
DUNGENESS CRAB (M)	0.0	0.0	0.0	0.0	0.0	1.6
DUNGENESS CRAB (F)	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL DUNGENESS CRAB	0.0	0.0	0.0	0.0	0.0	1.6
RED KING CRAB (M)	0.0	0.0	0.0	0.0	0.0	0.0
RED KING CRAB (F)	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL KING CRAB	0.0	0.0	0.0	0.0	0.0	0.0
TANNER CRAB (M)	17.2	48.0	10.4	1.2	0.0	0.0
TANNER CRAB (F)	0.8	15.8	5.6	0.0	0.0	0.0
TOTAL TANNER CRAB	18.0	63.8	16.0	1.2	0.0	0.0
TOTAL CRAB	18.0	63.8	16.0	1.2	0.0	1.6
OTHER INVERTEBRATES	55.2	0.0	12.0	53.5	0.0	197.1
ALASKA PLAICE	15.7	0.0	0.0	0.0	0.0	0.0
ARROWTOOTH FLOUNDER	810.2	816.0	2855.5	3128.8	8138.7	788.5
BUTTER SOLE	0.0	0.0	0.0	0.0	0.0	71.7
DOVER SOLE	361.9	47.6	343.9	145.3	456.3	0.0
ENGLISH SOLE	62.9	0.0	623.9	313.6	0.0	0.0
FLATHEAD SOLE	4774.9	2230.3	747.9	787.9	821.3	537.6
HALIBUT	329.6	357.0	148.8	71.2	113.6	20.7
REX SOLE	243.9	20.4	0.0	1109.2	713.5	0.0
ROCK SOLE	62.9	0.0	80.0	0.0	0.0	89.6
STARRY FLOUNDER	196.7	0.0	0.0	0.0	0.0	3154.1
YELLOWFIN SOLE	31.5	0.0	80.0	0.0	0.0	15896.1
TOTAL FLATFISH	6890.2	3471.3	4880.0	5556.1	10243.4	20558.3
DUSKY ROCKFISH	0.0	0.0	0.0	84.1	0.0	0.0
HERRING	0.0	0.0	0.0	0.0	0.0	0.0
PACIFIC COD	936.1	0.0	323.9	122.0	0.0	0.0
POLLOCK	2831.9	4542.2	160.0	1950.7	107.9	215.1
SABLEFISH	37.2	0.0	108.4	780.3	80.8	0.0
SCULPINS	23.6	0.0	196.0	30.6	0.0	555.6
OTHER ROUNDFISH	0.0	0.0	0.0	38.2	0.0	0.0
TOTAL ROUNDFISH	3828.8	4542.2	788.3	3005.9	188.7	770.7
SKATES	0.0	0.0	0.0	0.0	0.0	244.0

Appendix 1. (Continued)

HAUL NUMBER	14	15	16	17	18	19
BAY OR STATION	SPIRIDON	SPIRIDON	SPIRIDON	SPIRIDON	SPIRIDON	SPIRIDON
STATION NUMBER	UYI-A	UYH-A	UYH-B	UGH-B	UYG-A	UYH-B
MONTH/DAY/YEAR	11/15/87	11/15/87	11/15/87	11/15/87	11/15/87	11/15/87
LATITUDE START	57 40	57 40	57 39	57 39	57 39	57 38
LONGITUDE START	153 44	153 44	153 45	153 49	153 49	153 45
DEPTH (FATHOMS)	14	40	54	72	63	51
DURATION (MINUTES)	8	15	7	10	12	17
DISTANCE TOWED (KM)	0.74	1.39	0.65	0.93	1.11	1.58
GEAR PERFORMANCE	1	1	1	1	1	1
NET TYPES	1	1	1	1	2	2
TOTAL CATCH (KG)	3320	6803	1115	4531	548	1306
TOTAL CATCH (KG/HR)	24900	27212	9557	27186	2740	4610
TOTAL CATCH (KG/M^2)	0.33	0.36	0.13	0.36	0.04	0.06
			(SPECIES KG/HR)			
DUNGENESS CRAB (M)	0.0	0.0	0.0	0.0	3.5	28.9
DUNGENESS CRAB (F)	0.0	0.0	0.0	0.0	0.0	7.7
TOTAL DUNGENESS CRAB	0.0	0.0	0.0	0.0	3.5	36.6
RED KING CRAB (M)	0.0	0.0	0.0	0.0	0.0	0.0
RED KING CRAB (F)	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL KING CRAB	0.0	0.0	0.0	0.0	0.0	0.0
TANNER CRAB (M)	0.0	0.0	0.0	13.8	86.5	48.4
TANNER CRAB (F)	0.0	0.0	0.0	0.6	54.0	70.6
TOTAL TANNER CRAB	0.0	0.0	0.0	14.4	140.5	119.0
TOTAL CRAB	0.0	0.0	0.0	14.4	144.0	155.6
OTHER INVERTEBRATES	0.0	0.0	393.7	666.7	190.9	259.2
ALASKA PLAICE	0.0	295.9	424.0	0.0	0.0	97.8
ARROWTOOTH FLOUNDER	38.3	273.1	799.5	3410.3	366.5	430.3
BUTTER SOLE	0.0	0.0	0.0	0.0	0.0	0.0
DOVER SOLE	0.0	0.0	0.0	769.2	0.0	0.0
ENGLISH SOLE	0.0	1092.5	430.0	3179.5	0.0	78.2
FLATHEAD SOLE	248.8	2412.7	4778.8	12615.4	1577.8	2366.7
HALIBUT	10.5	188.4	70.3	24.6	80.5	35.7
REX SOLE	0.0	0.0	0.0	0.0	0.0	0.0
ROCK SOLE	38.3	182.1	0.0	51.3	28.0	0.0
STARRY FLOUNDER	1970.9	21327.0	551.2	384.6	17.8	572.1
YELLOWFIN SOLE	20914.7	1320.1	502.7	589.7	50.9	303.2
TOTAL FLATFISH	23221.5	27091.8	7556.5	21024.6	2121.5	3884.0
DUSKY ROCKFISH	0.0	0.0	0.0	0.0	0.0	0.0
HERRING	57.4	0.0	0.0	0.0	0.0	9.8
PACIFIC COD	0.0	0.0	0.0	339.6	63.6	0.0
POLLOCK	1129.0	113.8	127.2	5000.0	127.2	220.0
SABLEFISH	0.0	6.0	34.3	39.6	26.5	38.5
SCULPINS	38.3	0.0	6.1	51.3	43.3	4.9
OTHER ROUNDFISH	287.0	0.0	0.0	0.0	2.5	38.1
TOTAL ROUNDFISH	1511.7	119.8	167.5	5430.5	263.1	311.3
SKATES	166.5	0.0	1438.3	50.2	20.5	0.0

Appendix 2. Distribution of catch by haul selected species where catch > 0. From the November 1987 ADF&G trawl survey, Kodiak Island.

DUNGENESS(M)	
Haul	Kg/hr
19	28.9
2	6.8
4	4.8
18	3.5
1	2.0
13	1.6

DUNGENESS(F)	
19	7.7
2	4.4
1	2.0
3	1.1
4	0.8

KING CRAB(F)	
3	2.8
2	0.4

KING CRAB(M)	
2	10.8
3	2.8

TANNER CR.(F)	
19	70.6
18	54.0
3	24.2
9	15.8
4	14.4
10	5.6
2	5.6
8	0.8
17	0.6
1	0.4

TANNER CR.(M)	
18	86.5
19	48.4
9	48.0
3	27.2
4	25.2
8	17.2
17	13.8
10	10.4
1	1.6
2	1.6
1	1.2
7	0.6

ALASKA PLAICE	
Haul	Kg/hr
1	795.4
16	424.0
15	295.9
4	269.3
2	181.3
19	97.8
5	43.1
8	15.7

ARROWTOOTH FL.	
12	8138.7
17	3410.3
11	3128.8
10	2855.5
7	1643.1
9	816.0
8	810.2
16	799.5
13	788.5
4	584.0
19	430.3
3	390.1
18	366.5
2	330.4
15	273.1
1	95.4
5	38.9
14	38.3

BUTTER SOLE	
13	71.7
5	5.6

DOVER SOLE	
17	769.2
7	507.9
12	456.3
8	361.9
10	343.9
11	145.3
9	47.6
3	33.2

ENGLISH SOLE	
Haul	Kg/hr
17	3179.5
15	1092.5
10	623.9
4	444.5
16	430.0
11	313.6
19	78.2
8	62.9
7	23.9

FLATHEAD SOLE	
17	12615.4
16	4778.8
8	4774.9
15	2412.7
19	2366.7
9	2230.3
18	1577.8
4	1327.1
2	1192.6
3	1023.6
12	821.3
11	787.9
10	747.9
13	537.6
1	503.7
7	304.7
14	248.8
5	175.1

HALIBUT	
3	712.2
9	357.0
8	329.6
7	222.0
4	209.2
15	188.4
10	148.8
12	113.6
18	80.5
11	71.2
16	70.3
5	51.2
19	35.7
17	24.6
13	20.7
1	16.4
2	15.2
14	10.5

REX SOLE	
Haul	Kg/hr
11	1109.2
12	713.5
7	349.5
8	243.9
4	42.2
9	20.4
5	1.4

ROCK SOLE	
5	619.9
2	278.0
15	182.1
1	151.1
13	89.6
10	80.0
4	71.4
8	62.9
17	51.3
14	38.3
18	28.0
7	6.0

STARRY FLOUND	
15	21327.0
13	3154.1
14	1970.9
2	1164.4
1	676.1
19	572.1
16	551.2
17	384.6
8	196.7
18	17.8

YELLOWFIN SOLE	
14	20914.7
13	15896.1
1	2089.1
2	1587.5
15	1320.1
17	589.7
16	502.7
5	450.3
4	389.4
19	303.2
10	80.0
18	50.9
7	35.8
8	31.5
3	16.6

HERRING	
Haul	Kg/hr
14	57.4
19	49.8

PACIFIC COD	
8	936.1
17	339.6
10	323.9
4	146.0
11	122.0
7	93.0
18	63.6
5	49.6

POLLOCK	
17	5000.0
9	4542.2
8	2831.9
11	1950.7
3	1795.4
14	1129.0
7	472.0
19	220.0
13	215.1
10	160.0
18	127.2
16	127.2
15	113.8
12	107.9
4	64.9
2	16.1
5	9.7

SABLEFISH	
11	780.3
10	108.4
12	80.8
17	39.6
19	38.5
8	37.2
16	34.3
18	26.5
7	18.0
15	6.0
3	2.6

Appendix 3. Length frequency by species for Viekoda Bay. Lengths presented are the midpoints of a 1 cm range (e.g., 17 cm = 16.5 to 17.5 cm). From the November 1987 trawl survey, Kodiak Island.

Length (cm)	Halibut	Flathead Sole	Rock Sole	Rex Sole	Alaska Plaice	Dover Sole	Yellowfin Sole	Starry Flound	Pollock	Sable-fish
17	0	2	1	0	0	0	1	0	0	0
18	0	1	0	0	0	0	1	0	0	0
19	0	3	0	0	0	0	3	0	0	0
20	0	3	0	0	0	0	3	0	0	0
21	0	8	0	0	0	0	2	0	0	0
22	0	8	1	0	0	0	1	0	0	0
23	0	14	1	0	0	0	4	0	0	0
24	0	24	0	0	0	0	14	0	0	0
25	0	39	3	0	0	0	23	0	0	0
26	0	49	2	1	0	0	29	0	0	0
27	0	66	4	0	0	0	41	0	0	0
28	0	58	4	1	0	0	26	0	0	0
29	0	64	2	2	0	0	37	0	0	0
30	0	46	2	3	0	0	20	0	0	0
31	0	35	1	0	0	1	12	0	1	0
32	0	30	0	1	0	0	5	0	0	0
33	0	38	1	0	0	0	0	0	4	0
34	1	13	2	0	0	1	1	0	2	0
35	0	14	1	2	0	1	0	1	2	0
36	0	8	2	2	0	1	1	0	7	0
37	0	1	0	0	0	1	1	0	10	0
38	1	3	3	0	0	2	0	2	9	1
39	0	0	1	0	0	1	0	1	13	0
40	2	1	1	0	0	1	0	3	10	0
41	3	1	0	0	0	0	0	1	13	4
42	1	0	0	0	0	0	0	1	16	1
43	3	0	0	0	0	0	0	2	10	0
44	3	0	0	0	1	0	0	3	13	0
45	3	1	0	0	1	0	0	2	14	1
46	2	0	0	0	1	0	0	1	16	0
47	12	0	0	0	1	0	0	3	20	0
48	2	0	0	0	0	0	0	0	12	1
49	0	0	0	0	0	0	0	2	4	0
50	4	0	0	0	0	0	0	3	8	0
51	6	0	0	0	0	0	0	1	6	0
52	10	0	0	0	0	0	0	0	7	0
53	5	0	0	0	0	0	0	1	4	0
54	12	0	0	0	0	0	0	2	3	0
55	8	0	0	0	0	0	0	0	5	0
56	8	0	0	0	0	0	0	1	1	0
57	11	0	0	0	0	0	0	1	1	0

-Continued-

Appendix 3. (Continued)

Length (cm)	Halibut	Flathead Sole	Rock Sole	Rex Sole	Alaska Plaice	Dover Sole	Yellowfin Sole	Starry Flound	Pollock	Sable-fish
58	0	0	0	0	0	0	0	0	1	0
59	5	0	0	0	0	0	0	0	1	0
60	8	0	0	0	0	0	0	0	0	0
61	8	0	0	0	0	0	0	0	0	0
62	7	0	0	0	0	0	0	1	1	0
63	3	0	0	0	0	0	0	0	0	0
64	9	0	0	0	0	0	0	0	1	0
65	2	0	0	0	0	0	0	0	0	0
66	3	0	0	0	0	0	0	0	0	0
67	3	0	0	0	0	0	0	0	0	0
68	4	0	0	0	0	0	0	0	0	0
69	1	0	0	0	0	0	0	0	0	0
70	3	0	0	0	0	0	0	0	0	0
72	1	0	0	0	0	0	0	0	0	0
73	2	0	0	0	0	0	0	0	0	0
74	1	0	0	0	0	0	0	0	0	0
75	3	0	0	0	0	0	0	0	0	0
76	1	0	0	0	0	0	0	0	0	0
77	3	0	0	0	0	0	0	0	0	0
79	1	0	0	0	0	0	0	0	0	0
80	2	0	0	0	0	0	0	0	0	0
81	1	0	0	0	0	0	0	0	0	0
84	1	0	0	0	0	0	0	0	0	0
85	1	0	0	0	0	0	0	0	0	0
90	1	0	0	0	0	0	0	0	0	0
91	2	0	0	0	0	0	0	0	0	0
92	1	0	0	0	0	0	0	0	0	0
99	1	0	0	0	0	0	0	0	0	0
106	1	0	0	0	0	0	0	0	0	0
111	1	0	0	0	0	0	0	0	0	0
118	1	0	0	0	0	0	0	0	0	0
Total	186	530	32	12	4	9	225	32	215	8

Appendix 4. Length frequency by species for Kupreanof Strait. Lengths presented are the midpoints of a 1 cm range (e.g., 16 cm = 15.5 to 16.5). From the November 1987 ADF&G trawl survey, Kodiak Island.

Length (cm)	Halibut	Flathead Sole	Rock Sole	Rex Sole	Alaska Plaice	Dover Sole	English Sole	Yellowfin Sole	Pollock	Sable-fish
16	0	0	1	0	0	0	0	0	0	0
17	0	1	0	0	0	0	0	1	0	0
18	0	0	1	0	0	0	0	0	0	0
19	0	1	0	0	0	0	0	1	0	0
20	0	1	1	0	0	0	0	1	0	0
21	0	1	3	0	0	0	0	5	0	0
22	0	3	5	0	0	0	0	3	0	0
23	0	5	3	0	0	0	0	1	0	0
24	0	5	11	2	0	0	0	1	0	0
25	0	7	15	0	0	0	0	5	0	0
26	0	20	17	0	0	1	0	8	0	0
27	0	30	21	8	0	2	0	15	0	0
28	0	33	19	8	0	2	0	10	0	0
29	0	27	15	7	0	2	2	11	0	0
30	0	30	12	16	0	3	2	7	0	0
31	0	23	12	28	0	0	0	13	0	0
32	0	22	10	16	0	4	6	6	0	0
33	0	17	9	15	0	3	1	6	0	0
34	0	7	5	18	0	5	4	2	1	0
35	1	15	2	15	1	6	6	0	1	0
36	0	1	3	13	0	6	7	1	0	1
37	0	2	2	6	2	3	4	0	1	0
38	2	2	2	5	1	2	3	1	1	0
39	2	0	0	3	1	3	7	0	0	1
40	2	0	0	0	1	2	3	0	0	5
41	0	0	0	0	1	2	3	0	0	5
42	4	0	0	0	1	1	1	0	2	2
43	6	0	0	0	1	3	0	0	2	3
44	5	0	0	0	0	0	0	0	5	2
45	4	0	0	1	0	0	1	0	1	1
46	2	0	0	0	0	0	1	0	2	2
47	1	0	0	0	0	0	1	0	5	0
48	0	0	0	0	1	0	0	0	3	1
49	2	0	0	0	0	0	1	0	4	1
50	0	0	0	0	0	0	2	0	3	2
51	1	0	0	0	0	0	0	0	5	4
52	2	0	0	0	0	0	0	0	3	3
53	1	0	0	0	0	0	0	0	1	2
54	0	0	0	0	0	0	0	0	4	5
55	0	0	0	0	0	0	0	0	0	1
56	4	0	0	0	0	0	0	0	1	0

-Continued-

Appendix 4. (Continued)

Length (cm)	Halibut	Flathead Sole	Rock Sole	Rex Sole	Alaska Plaice	Dover Sole	English Sole	Yellowfin Sole	Pollock	Sablefish
57	1	0	0	0	0	0	0	0	1	0
58	2	0	0	0	0	0	0	0	2	3
59	2	0	0	0	0	0	0	0	0	2
60	2	0	0	0	0	0	0	0	0	0
62	3	0	0	0	0	0	0	0	0	0
63	1	0	0	0	0	0	0	0	0	0
64	3	0	0	0	0	0	0	0	0	0
68	1	0	0	0	0	0	0	0	0	0
69	1	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	1	0
71	1	0	0	0	0	0	0	0	0	0
73	1	0	0	0	0	0	0	0	0	0
76	1	0	0	0	0	0	0	0	0	0
80	2	0	0	0	0	0	0	0	0	0
81	2	0	0	0	0	0	0	0	0	0
85	1	0	0	0	0	0	0	0	0	0
93	1	0	0	0	0	0	0	0	0	0
94	1	0	0	0	0	0	0	0	0	0
103	1	0	0	0	0	0	0	0	0	0
119	1	0	0	0	0	0	0	0	0	0
Total	67	253	169	161	10	50	55	98	49	47

Appendix 5. Length frequency by species for Spiridon Bay. Lengths presented are the midpoints of a 1 cm (e.g., 16 cm = 15.5 to 16.5 cm). From the November 1987 ADF&G trawl survey, Kodiak Island.

Length (cm)	Halibut	Flathead Sole	English Sole	Yellowfin Sole	Starry Flound	Pollock	Sable-fish
15	0	1	0	0	0	0	0
16	0	2	0	0	0	0	0
17	0	3	0	0	0	0	0
18	0	3	0	0	0	0	0
19	0	3	0	0	0	0	0
20	0	2	0	0	0	0	0
21	0	9	0	1	0	0	0
22	0	21	0	0	0	0	0
23	0	21	0	7	0	0	0
24	0	36	0	10	0	0	0
25	0	47	0	17	0	0	0
26	0	74	0	11	0	0	0
27	0	88	0	17	2	0	0
28	0	64	0	13	0	0	0
29	0	52	0	24	0	0	0
30	0	23	0	37	1	0	0
31	0	19	0	26	5	0	0
32	0	6	4	23	3	0	0
33	0	14	4	17	5	0	0
34	0	7	2	2	5	2	0
35	0	5	7	7	10	2	0
36	0	3	1	2	5	2	0
37	0	2	4	0	3	4	1
38	0	1	3	0	5	2	0
39	0	0	7	0	4	2	3
40	0	0	2	0	5	5	7
41	0	0	1	0	3	4	5
42	0	0	3	0	4	2	7
43	0	0	1	0	6	1	5
44	0	0	1	0	10	3	1
45	1	0	0	0	8	2	1
46	0	0	0	0	6	3	0
47	0	0	1	0	3	2	0
48	0	0	0	0	4	1	1
49	1	0	3	0	4	0	1
50	0	0	0	0	2	0	1
51	1	0	0	0	1	2	0
52	2	0	0	0	3	2	0
53	0	0	0	0	0	1	0
54	0	0	0	0	3	0	0
56	0	0	0	0	1	0	0
57	0	0	0	0	1	0	0
58	1	0	0	0	0	0	0
60	0	0	0	0	1	0	0
61	1	0	0	0	2	0	0
Total	Cont'd	506	44	214	115	42	33

Continued

Length (cm)	Halibut
62	1
63	1
64	1
65	1
66	1
68	1
70	1
71	1
73	3
75	1
106	1
Total	20

Appendix 6. Crab width frequencies, November 1987. Lengths presented on the midpoints of a 1 mm (e.g., 34 mm = 33.5 to 34.5 mm). From the November 1987 ADF&G trawl survey, Kodiak Island.

	VIEKODA BAY					KUPREANOF STRAIT			SPIRIDON BAY		
Length (mm)	Male Tanner Crab	Female Tanner Crab	Dunge. Crab	Male King Crab	Female King Crab	Male Tanner Crab	Female Tanner Crab	Dunge. Crab	Male Tanner Crab	Female Tanner Crab	Dunge. Crab
34	0	0	0	0	0	0	1	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0
45	0	1	0	0	0	0	0	0	1	0	0
50	1	0	0	0	1	0	0	0	0	0	0
53	1	0	0	0	1	0	1	0	0	0	0
56	0	1	0	1	1	0	0	0	0	0	0
57	1	1	0	0	0	0	0	0	0	0	0
58	1	1	0	0	0	1	0	0	0	0	0
59	2	0	0	0	0	0	0	0	0	0	0
60	1	0	0	0	0	0	0	0	0	0	0
61	1	0	0	0	0	0	0	0	0	0	0
62	1	0	0	1	0	1	0	0	0	0	0
63	0	0	0	0	0	0	1	0	0	0	0
64	0	0	0	0	0	0	1	0	0	0	0
65	0	1	0	0	0	0	0	0	0	0	0
66	1	0	0	0	0	0	0	0	0	0	0
70	1	0	0	1	0	1	1	0	0	0	0
71	0	0	0	0	0	1	0	0	0	0	0
72	0	0	0	0	0	1	0	0	0	0	0
73	2	0	0	0	0	0	0	0	0	0	0
74	1	0	0	1	1	3	0	0	0	0	0
75	0	2	0	0	0	1	0	0	0	0	0
76	0	1	0	0	0	0	0	0	0	0	0
78	0	2	0	1	0	0	0	0	0	0	0
80	1	0	0	0	1	0	0	0	0	0	0
81	1	0	0	0	1	0	1	0	0	0	0
82	0	0	0	1	0	1	0	0	0	1	0
83	0	4	0	0	0	0	0	0	0	0	0
84	0	1	0	1	0	0	0	0	0	1	0
85	2	3	0	0	0	0	0	0	0	1	0
86	1	3	0	1	0	0	0	0	0	1	0
88	1	2	0	0	0	0	1	0	0	0	0
89	0	2	0	0	0	0	1	0	1	3	1
90	0	3	0	1	0	0	0	0	0	0	0
91	0	1	0	0	0	0	0	0	0	0	0
92	0	1	0	1	0	0	0	0	1	4	0
93	0	2	0	0	0	0	0	0	0	1	0

-Continued-

Appendix 6. (Continued).

Length (mm)	VIEKODA BAY					KUPREANOF STRAIT			SPIRIDON BAY		
	Male Tanner Crab	Female Tanner Crab	Dunge. Crab	Male King Crab	Female King Crab	Male Tanner Crab	Female Tanner Crab	Dunge. Crab	Male Tanner Crab	Female Tanner Crab	Dunge. Crab
94	0	0	0	0	0	0	1	0	2	0	0
95	0	0	0	0	0	0	2	0	0	5	0
96	0	1	0	0	0	1	3	0	1	5	0
97	0	1	0	0	0	0	1	0	2	3	1
98	0	1	0	0	0	0	0	0	1	8	0
99	0	1	0	0	0	1	0	0	0	2	0
100	1	2	0	0	0	0	2	0	2	2	0
101	0	2	0	0	0	0	1	0	0	1	0
102	0	1	0	0	0	0	1	0	1	10	1
103	0	0	0	0	0	0	2	0	0	10	1
104	1	0	0	0	0	2	0	0	0	8	0
105	0	1	0	0	0	1	2	0	1	6	0
106	0	2	0	0	0	0	1	0	1	1	2
107	0	0	0	0	0	1	0	0	1	2	0
108	1	0	0	0	0	0	0	0	0	4	0
109	0	0	0	0	0	0	0	0	0	1	1
110	0	0	0	0	0	1	0	0	0	5	0
111	0	0	0	0	0	0	0	0	0	1	0
112	3	0	0	0	0	0	0	0	0	3	2
113	1	0	0	0	0	0	0	0	0	2	0
114	0	1	0	0	0	0	0	0	1	0	0
115	1	0	0	0	0	0	0	0	0	2	0
116	1	1	0	0	0	0	0	0	2	0	0
117	0	0	0	0	0	0	0	0	1	0	0
118	1	0	0	0	0	0	0	0	0	1	0
119	0	0	0	0	0	0	0	0	3	1	0
120	0	1	0	0	0	1	0	0	0	0	0
121	1	0	0	0	0	0	0	0	2	0	0
122	0	0	0	0	0	0	0	0	2	0	1
123	0	0	0	0	0	0	0	0	3	0	1
124	0	0	0	0	0	0	0	1	0	1	0
125	2	0	0	0	0	0	0	0	1	0	0
126	1	0	0	0	0	0	0	1	0	0	0
127	0	0	0	0	0	0	0	0	1	0	0
128	3	0	0	0	0	0	0	0	0	0	0
129	1	0	0	0	0	2	0	0	1	0	1
130	1	0	0	0	0	0	0	0	1	0	0
131	0	0	0	0	0	2	0	0	1	0	0
132	1	0	0	0	0	0	0	0	1	0	0

-Continued-

Appendix 6. (Continued).

Length (mm)	VIEKODA BAY					KUPREANOF STRAIT			SPIRIDON BAY		
	Male Tanner Crab	Female Tanner Crab	Dunge. Crab	Male King Crab	Female King Crab	Male Tanner Crab	Female Tanner Crab	Dunge. Crab	Male Tanner Crab	Female Tanner Crab	Dunge. Crab
133	1	0	0	0	0	1	0	0	1	0	0
134	2	0	0	0	0	0	0	0	1	0	0
135	1	0	0	0	0	1	0	0	2	0	0
136	2	0	1	0	0	0	0	0	3	0	1
137	1	0	0	0	0	1	0	0	3	0	1
138	1	0	1	0	0	1	0	0	4	0	0
139	0	0	1	0	0	0	0	0	2	0	0
140	0	0	0	0	0	0	0	0	1	0	0
141	0	0	0	0	0	0	0	0	1	0	0
142	0	0	0	0	0	0	0	0	0	0	1
143	1	0	0	0	0	0	0	0	0	0	0
144	1	0	0	0	0	0	0	0	0	0	0
146	1	0	0	0	0	0	0	0	1	0	0
147	1	0	0	0	0	0	0	0	0	0	0
149	0	0	1	0	0	0	0	0	0	0	0
150	1	0	0	0	0	0	0	0	1	0	0
152	0	0	0	0	0	0	0	0	0	0	0
154	0	0	1	0	0	0	0	0	0	0	0
155	1	0	0	0	0	0	0	0	0	0	1
157	0	0	1	0	0	0	0	0	0	0	0
158	0	0	1	0	0	0	0	0	0	0	0
161	0	0	0	0	0	0	0	0	0	0	0
163	0	0	0	0	0	0	0	0	0	0	1
164	1	0	0	0	0	0	0	0	0	0	0
169	1	0	0	0	0	0	0	0	0	0	1
170	0	0	0	0	0	0	0	0	0	0	2
171	0	0	0	0	0	0	0	0	0	0	2
173	0	0	0	0	0	0	0	1	0	0	1
176	0	0	0	0	0	0	0	0	0	0	1
179	0	0	1	0	0	0	0	0	0	0	0
TOTAL	56	47	8	10	6	26	24	3	55	96	25